

determining resolution of said imaging system from feature size and pitch in respective sub-fields inspected in said inspecting step.

6. (Amended) A target for determining resolution of an imaging system by inspecting an image of said target for Moire' fringes in respective sub-fields of an image of said target, said target including

a plurality of sub-fields, respective sub-fields including a plurality of features, said plurality of features of respective sub-fields of said plurality of sub-fields having a progression of image feature size and pitch encompassing the spatial resolution of said imaging system, referred to an object plane of said imaging system.

REMARKS

Claims 1 - 12 remain active in this application. Claims 1 and 6 have been amended to improve form and to avoid an unintended construction of the claimed subject matter. No new matter has been introduced into the application.

Claims 1 - 7 have been rejected under 35 U.S.C. §102 as being anticipated by Harshbarger, Jr., et al/; claims 6 - 7 have been rejected under 35U.S.C. §102 as being anticipated by Hibbs et al. or Sussmeier and claims 8 - 12 have been rejected under 35 U.S.C. §103 as being unpatentable over Sussmeier in view of Neyman. These grounds of rejection are respectfully traversed, particularly as being moot in view of the amendments made above.

While the Examiner has not raised any issue of form or definiteness of the claims, it is respectfully submitted that all of the above grounds of rejection clearly rely on a construction or interpretation of the claim language contrary to the actual substance of the

invention, the intentions of the Applicant and, it is respectfully submitted, the explicit language of the claims. However, to the extent, if any, that any ambiguity is present in the claims which would tend to support the Examiner's position in regard to any of the above grounds of rejection, such ambiguity has clearly been removed by the amendments made above. Therefore, it is respectfully submitted that the rejections of record are in error as to the claims, as filed, and appear to indicate a substantial lack of understanding of important aspects of the invention while the originally filed claims have been amended in a manner such that the Examiner's evident construction of the claims and, hence, the stated grounds of rejection are no longer tenable.

Specifically, the invention, whether as apparatus or method, involves a target having a plurality of sub-fields wherein the respective sub-fields have features of a particular size and pitch and where, the size and pitch dimensions of the respective sub-fields across the target encompass the pitch of pixels in an image sensor and, hence, the resolution of a camera including that sensor. If the pitch of the sub-field image features, when imaged on the sensor, differs from the pixel pitch of the sensor, Moiré patterns are produced in the sub-field image due to beating of the spatial frequency of the features against the spatial frequency of the pixels. Therefore, the actual resolution of a camera, referred to the object plane, can be determined by inspection of the image of the target for a sub-field in which no Moiré pattern is present; thus providing an important and often critical measure of camera performance through an extremely simple feature and at low cost using the only hardware requirement is the target, itself. Nevertheless, to support this meritorious function, there must be an association of the size and pitch of features with a sub-field in

which features of that size and pitch are provided there must be a difference in size and pitch of features in the respective sub-fields and the range of sizes and pitches provided by the respective sub-fields of the plurality of sub-fields of the target must encompass the resolution of the camera or sensor therein.

These features are respectfully submitted to be clearly and unambiguously described in the claims as originally filed and are not all answered by the references applied by the Examiner, particularly the passages and illustrations cited in the present office action. Specifically, as to Harshbarger, Jr., et al., the Examiner call attention to Figure 4H as answering the terms of the claims while Figure 4H actually only shows three sets of lines of at very few lines each at different spacings seemingly unrelated to line width and, moreover, all of Figures 4A - 4J are screen patterns for evaluating parameters of the display and not sub-fields, much less sub-fields of a target where respective sub-fields have the properties recited which are specific to measurement of resolution by inspection; 4H being described as merely "a Video pattern screen" (column 9, lines 27 - 53) and evidently unsuitable for the production of Moiré patterns by matching of pixel spacing due to the paucity of lines, coarseness of lines relative to full image size and seemingly arbitrary spacing between lines and, especially, the wide variation between line widths and pitches, while Figure 4F (possibly resembling a single sub-field of the invention but not the entirety of the target, as claimed) is disclosed as "a resolution target, evidently to determine whether the linear features can be resolved or not but not providing a teaching or suggestion of a target or technique by which a measurement of resolution can be performed by inspection, as provided by the present invention.

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Screen is
the target!

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In regard to Hibbs et al., the Examiner cites only Figure 1 which is an exposure mask image (for monitoring exposure of a lithographic exposure tool) rather than resolution in an imaging system) disclosed to have nine regions, all but the center region of which are of equal size and include a single line and a single space (and thus incapable of producing Moiré patterns) such that the amount of exposure differs between regions depending on relative line and space width and, more importantly, *all of the regions are of a width below the resolution of a lithographic exposure tool* such that the regions are not separately imaged and the entire mask produces an image of a "single, Broad, diffuse line" (column 3, line 66 to column 4, line 5). Therefore, even if it is considered that the respective regions correspond to claimed sub-fields, the sub-fields have only a single feature each, a constant pitch across all sub-fields, and the range of sizes and pitches *does not encompass the resolution of the camera*. Therefore, Hibbs et al. is very different from the present invention and it is unclear from the Examiner's statement of the rejection based on Hibbs et al. how the Hibbs et al. reference could be construed in a manner to even *arguably* teach or suggest the subject matter which the Examiner attributes to it and comprising the great majority of the salient features of the invention explicitly recited in the claims.

Similarly, in regard to Sussmeier the Examiner relies on Figure 2 which is a mask for determining dynamic range and has regions of equal area of *featureless* black, white and intervening levels of gray while Figures 3 and 4 are test patterns for determining horizontal and vertical contrast (as differentiated from *spatial*) resolution but which have neither sub-fields nor differing feature sizes or pitches much less encompassing the spatial resolution of the imaging device by inspection through formation of Moiré

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No!
more
than
a single
feature

patterns if the pitch of the image feature at the focal plane is unequal to pixel pitch. Therefore, like Hibbs et al., Sussmeier does not contain the teachings or suggestions which the Examiner attributes to it (in a statement of the rejection substantially identical, but for the Figure reference, to the rejection based on Hibbs et al.) and does not answer the majority of the explicit recitations of the claims or provide evidence of a level of ordinary skill in the art which would support a conclusion of obviousness of the subject matter of any claim in the application.

Therefore, in summary, it is clearly seen that none of Harshbarger, Jr., et al., Hibbs et al. or Sussmeier anticipate any claim in the application even under the erroneous construction suggested by the Examiner's application of Figure 4H of Harshbarger, Jr., et al. or any other possible construction that is evident to the undersigned in regard to the applied references which appear to be utterly irrelevant to the claimed invention. Therefore, it is respectfully submitted that the rejections for anticipation are clearly in error in regard to the claims as originally filed and are even more erroneous and untenable in regard to the claims as amended above. Accordingly, it is respectfully requested that all of the rejection under 35 U.S.C. §102 be reconsidered and withdrawn.

It is equally evident that Neyman does not supplement Sussmeier or any other of the applied references in regard to the deficiencies thereof discussed above except as teaching a target with a plurality of sub-fields to which indicia are applied (the sole feature for which it is apparently applied by the Examiner). The sub-fields (and "blended strips of recognizable colors") are featureless (and thus cannot form Moiré patterns) and directed to gray scale, exposure latitude and color. Neyman thus does not teach or suggest most of the recited salient features

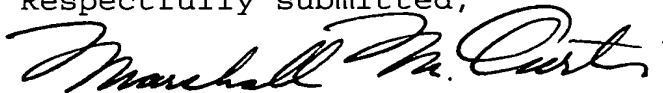
Not
featureless

of the invention absent from other references and does not provide evidence of a level of ordinary skill in the art which would support a conclusion of obviousness since it, in combination with any other applied prior art in any combination, does not lead to an expectation of success in providing accurate measurement of spatial resolution by inspection. Therefore, it is respectfully submitted that the rejection of claims 8 - 12 under 35 U.S.C. §103 is also clearly in error and reconsideration and withdrawal of the same is respectfully requested.

Since all rejections, objections and requirements contained in the outstanding official action have been fully answered and shown to be in error and/or inapplicable to the present claims, it is respectfully submitted that reconsideration is now in order under the provisions of 37 C.F.R. §1.111(b) and such reconsideration is respectfully requested. Upon reconsideration, it is also respectfully submitted that this application is in condition for allowance and such action is therefore respectfully requested.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2041.

Respectfully submitted,



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APPENDIX

Claims 1 and 6:

1. (Amended) A method of measuring resolution of an imaging system, said method comprising steps of
imaging a target including a plurality of sub-fields, respective sub-fields of said plurality of sub-fields providing [having] a progression of image feature size and pitch encompassing the spatial resolution of said imaging system, to produce a captured image,
inspecting said captured image for presence or absence of Moire' patterns in sub-fields of said captured image, and
determining resolution of said imaging system from feature size and pitch in respective sub-fields inspected in said inspecting step.

6. (Amended) A target for determining resolution of an imaging system by inspecting an image of said target for Moire' fringes in respective sub-fields of an image of said target, said target including
a plurality of sub-fields, [each subfield]
respective sub-fields including a plurality of features, said plurality of features of respective sub-fields of said plurality of [sub-fields] sub-fields having a progression of image feature size and pitch encompassing the spatial resolution of said imaging system, referred to an object plane of said imaging system.